

# Atlantic Richfield Company

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**Anthony R. Brown**  
Project Manager, Mining

September 13, 2017

Dana Barton and Gary Riley  
Remedial Project Manager, Superfund Division  
U.S. Environmental Protection Agency, Region 9  
75 Hawthorne Street (SFD 7-2)  
San Francisco, California 94105

**Subject: Response to U.S. EPA June 13, 2017 Comments on Focused Feasibility Study Geotechnical Evaluation Task Sampling and Analysis Plan**  
Leviathan Mine Site  
Alpine County, California

Dear Ms. Barton and Mr. Riley:

Atlantic Richfield Company (Atlantic Richfield) is submitting this letter in response to the U.S. Environmental Protection Agency's (U.S. EPA's) June 13, 2017 letter *ARC Response to EPA Comments on Focused Feasibility Study Geotechnical Evaluation Task Sampling and Analysis Plan, Leviathan Mine Site, Alpine County California dated February 9, 2017*. The Focused Feasibility Study Task Sampling and Analysis Plan was submitted in partial fulfillment of the requirements of the Statement of Work attached to the Administrative Order for Remedial Investigation and Feasibility Study, Comprehensive Environmental Response, Compensation, and Liability Act Docket No. 2008-18 issued by the U.S. EPA on June 23, 2008.

The U.S. EPA requested that Atlantic Richfield provide "the Geotechnical Technical memorandum outlining and summarizing the ARC process and items noted herein" within 90 days or by September 13, 2017. In lieu of the requested Technical Memorandum, Atlantic Richfield intends to provide a technical report that documents the results of geotechnical characterization conducted in the Focused Feasibility Study and our compilation and evaluation of other readily available geotechnical information as part of the Feasibility Study (FS) report. This is consistent with the approach and schedule for submission of RI/FS deliverables set forth in letters exchanged between U.S. EPA and Atlantic Richfield on May 17, 2017 and June 19, 2017. Atlantic Richfield's responses to U.S. EPA's June 13, 2017 comments are attached (Table 1). These responses along with the more extensive responses to U.S. EPA's July 8, 2016 comments submitted on February 9, 2017 summarize Atlantic Richfield's approach for collecting and evaluating geotechnical characterization data.

U.S. EPA noted "that additional geotechnical investigations will likely be necessary to complete the Remedial Design ... and the process should be such that information is gathered in advance and in a timely manner so as not to result in significant delays." The geotechnical characterization and evaluations that have been completed or will be completed in the near term are sufficient to support the FS evaluation of remedial alternatives, which will provide a basis for a remedy to be identified in the Proposed Plan and the Record of Decision (ROD). Remedial design will be conducted after the execution of the ROD. The geotechnical characterization, compilation of readily available information, and evaluation of that information will support the

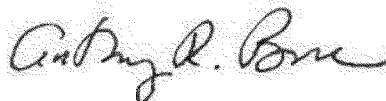


FS evaluation of remedial alternatives and subsequent remedial design activities. Atlantic Richfield recognizes that additional geotechnical information may be necessary during remedial design. However, without knowing what remedy will be identified in the Proposed Plan and ROD, it is impracticable to collect all geotechnical information that might be needed to support remedial design. Atlantic Richfield believes that the best approach for avoiding significant delays in selecting and implementing a final remedy is to follow a logical, step-wise approach consisting of the completion of the FS, preparation of a Proposed Plan, and execution of the ROD, followed by the implementation of remedial design and remedial action. Therefore, our approach for the completion of geotechnical characterization is to collect and evaluate geotechnical information needed to conduct the FS. Additional information, if any, needed for remedial design and remedial action will be collected during the remedial design phase.

The U.S. EPA requested that a copy of the slide that shows Geotechnical Study Areas be provided. Figure A-2 (attached) is the requested slide.

If you have any questions or comments, please feel free to contact me at (657) 5294537 or [anthony.brown@bp.com](mailto:anthony.brown@bp.com).

Sincerely,



Anthony R. Brown  
Project Manager, Mining

Attachments:

Table 1 Response to U.S. EPA Comments Dated June 13, 2017  
Figure A-2 Geotechnical Evaluation Areas

cc: John Hillenbrand, U.S. Environmental Protection Agency, Region 9 – via electronic copy  
Douglas Carey, Lahontan Regional Water Quality Control Board – via electronic copy  
Scott Ferguson, Lahontan Regional Water Quality Control Board – via electronic copy  
Nathan Block, Esq., BP – via electronic copy  
Adam Cohen, Esq., Davis Graham & Stubbs, LLP – via electronic copy  
Sandy Riese, EnSci, Inc. – via electronic copy  
Marc Lombardi, Amec Foster Wheeler – via electronic copy  
Grant Ohland, Ohland HydroGeo, LLC – via electronic copy  
Dave McCarthy, Copper Environmental Consulting – via electronic copy  
Cory Koger, U.S. Army Corps of Engineers – via electronic copy  
Greg Reller, Burseson Consulting – via electronic copy  
Ken Maas, U.S. Forest Service, Humboldt-Toiyabe National Forest – via electronic copy  
and hard copy  
Susan Jamerson, Washoe Tribe of California and Nevada – via electronic copy  
Neil Mortimer, Washoe Tribe of California and Nevada – via electronic copy

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September 13, 2017  
Page 3

Norman Harry, Washoe Tribe of California and Nevada – via electronic copy and hard copy

Cale Pete, Washoe Tribe of California and Nevada – via electronic copy

Fred Kirschner, AESE, Inc. – via electronic copy and hard copy

David Friedman, Nevada Division of Environmental Protection – via electronic copy

Toby McBride, U.S. Fish and Wildlife Service – via electronic copy

Steve Hampton, California Department of Fish and Wildlife – via electronic copy

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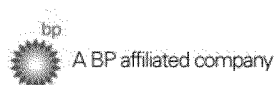




TABLE 1  
RESPONSE TO U.S. EPA COMMENTS DATED JUNE 13, 2017  
Leviathan Mine Site  
Alpine County, California

Comment No.	Comment	Response
Not numbered	<p><b>Former EPA comments dated July 8, 2017</b> [sic: should be 2016]: EPA noted that the Geotechnical work plan is incomplete and that it does not follow the tasks identified in the RI SOW attached to the June 2008 UAO. Nor does the work plan meet the objectives identified in the PWP and Programmatic DQOs. Atlantic Richfield's draft of the 2009 Programmatic Work Plan (PWP) acknowledged the need for geotechnical work in its own data quality objectives (DQO). Further, ARC's August 2010 On Property FRI Work Plan identified a geotechnical investigation (at Section 11). ARC's workplan does not include complete geotechnical investigation of landslides, high walls, mine waste, and pond areas in the current TSAP.</p> <p><b>ARC Response:</b> ARC notes that most of the geotechnical tasks identified in the SOW do not require collecting additional geotechnical characterization data for the FS. Further, that the DQOs have not changed and have simply been updated to conform to the EPA guidance. ARC also considers some of the documents to be historic and have served their intended purpose; noting that there has been a significant collection of additional geotechnical characterization data under the RI work plans that are sufficient to perform the assessments for the FS.</p> <p><b>EPA Response:</b> To facilitate discussion in advance of providing these written comments, EPA requested ARC provided an update of the data being collected and to be utilized at an in-person meeting held on May 23, 2017. It is EPA's understanding that the geotechnical assessment will be site-wide and will include but not be limited to; the Leviathan Creek Basin landslide, slope stability, and pond stabilization. Further, EPA understands that the FS, due on or before December 31, 2018; will clearly assess the long term and short-term impacts of slope movement on all remedies. Please fully consider and utilize the April 4, 2017 annotated table of contents, EPA's July 8, 2016 comments and the referenced documents to determine their applicability and usefulness at that time.</p>	<p>Regarding the statement that "EPA's understanding that the geotechnical assessment will be site-wide and will include but not be limited to; the Leviathan Creek Basin landslide, slope stability, and pond stabilization," Atlantic Richfield's geotechnical assessment is focused on conditions that may affect remedial alternatives that will be evaluated in the Feasibility Study (FS). That assessment includes evaluating slope stability and potential movement of the Leviathan Creek Basin Landslide and other slopes, but only where they might be expected to affect infrastructure included in a potential remedial alternative.</p> <p>Regarding the statement that "Further, EPA understands that the FS, due on or before December 31, 2018; will clearly assess the long term and short-term impacts of slope movement on all remedies," the FS will include evaluations of geotechnical considerations that may affect individual remedial alternatives. Geotechnical considerations do not apply to some remedial alternatives, such as No Action and Administrative Controls.</p> <p>Regarding the statement that "Please fully consider and utilize the April 4, 2017 annotated table of contents, EPA's July 8, 2016 comments and the referenced documents to determine their applicability and usefulness at that time," Atlantic Richfield will take these into consideration while preparing the FS.</p>
AC-1	<p><b>Geotechnical Technical Memorandum:</b> As discussed at the May 23, 2017 meeting. EPA looks forward to receiving ARC's technical summary outlining the process, schedule and the planned modelling and associated data inputs; that ARC anticipates will be used to support geotechnical evaluations necessary to complete the Feasibility study. Please outline a summary of the existing data that ARC plans to assess and evaluate; and why ARC finds that information to be sufficient.</p>	<p>Atlantic Richfield will provide the results of geotechnical characterization and evaluations as a component of the FS. For clarification, geotechnical characterization data and evaluations will not be included in the Site Characterization Report planned for submittal at the end of 2017. The following responses to U.S. EPA comments provide a summary of Atlantic Richfield's approach for collecting geotechnical data and completing evaluations to support the FS.</p> <p>The primary geotechnical considerations that may affect remedial infrastructure are slope stability and movement of landslides.</p> <p>To evaluate slope stability, Atlantic Richfield intends to use results from the geotechnical characterization of mine waste beneath Pond 2 North / 2 South, geologic information obtained in the Remedial Investigation (RI) hydrogeologic characterization program, published information for geologic materials similar to native materials at the site, and topographic information available from detailed site topographic maps as the basis for those assessments. Those assessments will be sufficient to inform FS evaluation of potential remedial alternatives. In the event that more rigorous slope stability evaluations are needed to support post-FS remedial design, they can be completed as needed during the initial phase of remedial design.</p> <p>With regard to unstable ground at landslides, the strategy for siting remedial infrastructure will be to avoid, to the extent practicable, known areas of unstable ground within the lateral limits of landslides. Previous investigations have delineated the Leviathan Creek Basin landslide and the Delta Slope landslide, and our review of recent aerial photographs generally confirmed those delineations. We expect that some remedial infrastructure, such as roads and pipelines, will cross potentially unstable ground. The existing delineations are sufficient to identify where infrastructure will be located relative to unstable ground associated with landslides.</p> <p>Future remedial infrastructure located on potentially unstable ground will be designed to accommodate moderate amounts of movement, and periodic inspection, maintenance, and repair will be included as a component of remedial alternatives. Although the amount of movement that may occur in the future at landslides</p>



TABLE 1  
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		or other slopes cannot be definitively determined, the lack of large-scale movement sufficient to damage infrastructure on the Leviathan Creek Basin Landslide following the unusually wet 2016-2017 winter is strong evidence that the landslide has not recently moved significantly.
AC-2	<b>Landslide Movement/Monitoring:</b> In the technical memo referenced in AC 1 above, please summarize the information supporting ARC's inference that the Leviathan Basin Landslide is not significantly active or moving. In addition, please develop and submit a field monitoring plan to support and continue to confirm this conclusion.	<p>Atlantic Richfield will provide the results of geotechnical characterization and evaluations as a component of the FS report.</p> <p>Atlantic Richfield has been implementing response actions at the site since about 2006, and we have been maintaining roads and maintaining existing infrastructure associated with Aspen Seep Bioreactor located within the lateral limits of the Leviathan Creek Basin Landslide during that period. Even following the exceptionally wet winter of 2016-2017, no movement of the landslide that resulted in maintenance or repair being required for roads or any existing infrastructure associated with the Aspen Seep Bioreactor has been noted.</p> <p>Atlantic Richfield plans to continue noting any maintenance or repair of roads or the Aspen Seep Bioreactor needed as a result of movement of unstable ground associated with the Leviathan Creek Basin Landslide. However, given the current absence of large-scale landslide movement, Atlantic Richfield does not believe that implementing a program, other than visual monitoring, for monitoring the movement of this landslide in detail is warranted or would provide information that would be useful in the FS.</p> <p>In contrast to the lack of significant ongoing movement of the Leviathan Creek Basin Landslide, unstable conditions developed on slope in mine waste east of Pond 4 in the spring of 2017. Evidence of unstable conditions was identified by visual observation of tension cracks and scarps. Those conditions resulted in temporary closure of a site road while the slope was stabilized and a toe bulge in the road was repaired. It is possible that other slopes could exhibit unstable conditions if unusually wet conditions occur in the future. The planned approach is to conduct periodic visual monitoring of slopes adjacent to roads or ponds during the spring when unstable conditions are more likely to develop than later in the year. The visual monitoring would focus on signs of distress or movement in slopes, such as tension cracks, scarps, and bulges. Visual monitoring is a rapid and cost effective means for identifying surficial slope movement.</p>
S1	<b>Study Areas:</b> Please provide a copy of the slide ARC presented at the May 23, 2017 technical meeting that shows the various Geotechnical (GT) Study areas. To date, ARC has provided a Sampling Analysis Plan for work in the "GT3" area only. ARC stated that there is sufficient existing data for the all the other Geotechnical Study Areas. In the technical memorandum noted above in AC1; please include a summary of the process to be utilized and the existing data inputs that ARC believes exists and are sufficient to complete the geotechnical assessment in accordance with the RI SOW. Some of this detail was provided in the response to comments table dated February 9, 2017 and should be incorporated into the Technical memorandum.	<p>The requested figure that shows the geotechnical study areas is attached.</p> <p>Atlantic Richfield will provide the results of geotechnical characterization and evaluations as a component of the FS report, but we are not planning to provide a separate geotechnical technical memorandum or report in advance of the FS.</p> <p>The response to U.S. EPA comments submitted by Atlantic Richfield on February 9, 2017, summarizes the approach and available data that are being used to address the geotechnical tasks identified in the Statement of Work (SOW) attached to the Unilateral Administrative Order (UAO). The geotechnical task descriptions in the SOW are provided below, and the process and data for addressing each SOW task are summarized. Refer to the responses submitted February 9, 2017, for more detailed information.</p> <p><b>SOW Task 1:</b> "Review of groundwater level data collected from groundwater monitoring wells in the vicinity of the Leviathan Mine."</p> <p><b>Process:</b> Prepare potentiometric surface maps, and use to identify pore pressure as needed for slope stability calculations.</p> <p><b>Data:</b> Water level data collected for the RI.</p> <p><b>Status:</b> Complete. The dataset and review thereof are sufficient to fulfill this task.</p>



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		<p><b>SOW Task 2:</b> "Completion of geophysical surveys across the Leviathan Mine and adjacent areas in an attempt to determine the stratigraphy and relative density of subsurface materials and identify subsurface geologic features that may affect stability."</p> <p><b>Process:</b> Geophysical surveys were completed in the Leviathan Creek area and the Pond 4 / Delta Area in 2011, and seismic refraction and refraction micro tremor surveys were conducted in the Pond 2 area in 2016. These studies were used to characterize stratigraphy. The RI hydrogeology drilling program provided additional information about the site-wide stratigraphy.</p> <p><b>Data:</b> Geophysical survey data were interpreted by geophysical specialists to identify stratigraphic units. The RI hydrogeology drilling program provided additional soil and rock characterization data that were used to describe site stratigraphy. The results of geophysical surveys and the characterization of site stratigraphy were summarized in the Groundwater Technical Data Summary Report dated January 25, 2017.</p> <p><b>Status:</b> Task complete.</p> <p><b>SOW Task 3:</b> "Visual inspection and assessment of the existing structures whether additional investigations are necessary."</p> <p><b>Process:</b> Pond embankments and facilities in the Pond 4 and Aspen Seep areas were visually inspected to support preparation of the Geotechnical Task Sampling and Analysis Plan (TSAP). Although no structural deficiencies were identified, additional investigation of the Pond 2 North / 2 South embankment was identified as being needed to provide information to support the FS.</p> <p><b>Data:</b> No quantitative data was generated by this visual inspection.</p> <p><b>Status:</b> Task complete.</p> <p><b>SOW Task 4:</b> "Completion of subsurface explorations to characterize the native materials beneath the mine waste piles and other areas of interest."</p> <p><b>Process:</b> The RI hydrogeology characterization program provided information on a site-wide basis. The Geotechnical Focused Feasibility Study (FFS) provided information at Pond 2 North / 2 South. The 2016 Geotechnical FFS characterization program consisted of core review, geophysical surveys, drilling two boreholes in mine waste, and geotechnical laboratory analysis. The planned 2017 characterization program consisted of drilling into native materials below mine waste, performing a geophysical survey in the borehole, installing instrumentation to measure pore pressure and slope movement, monitoring variations in pore pressure and slope movement, and conducting addition geotechnical laboratory analysis of native materials. A borehole was advanced into the upper portion of native materials, and drilling fluid circulation was lost. Measures to alleviate lost circulation were unsuccessful and the borehole was abandoned. Based on this experience, Atlantic Richfield decided that drilling methods that use drilling mud are not appropriate for that location. Although rotosonic drilling has been successfully used at the site in the hydrogeologic drilling program, it is not a suitable method for geotechnical drilling. Therefore, the geotechnical characterization of native materials beneath mine waste described in the Geotechnical FFS TSAP is not being performed and the characterization data for native material below mine waste at Pond 2 North/2 South is not being collected, nor is pore pressure or potential slope movement being monitored. In lieu of measured data for the native materials beneath the Pond 2 North / 2 South embankment, reasonable assumptions of geotechnical property values will be made based on published information for native materials similar to those identified via RI hydrogeologic characterization.</p> <p><b>Data:</b> Geophysical data, lithology, and geotechnical laboratory data for mine waste were collected at two geotechnical boreholes as part of the Geotechnical FFS.</p>



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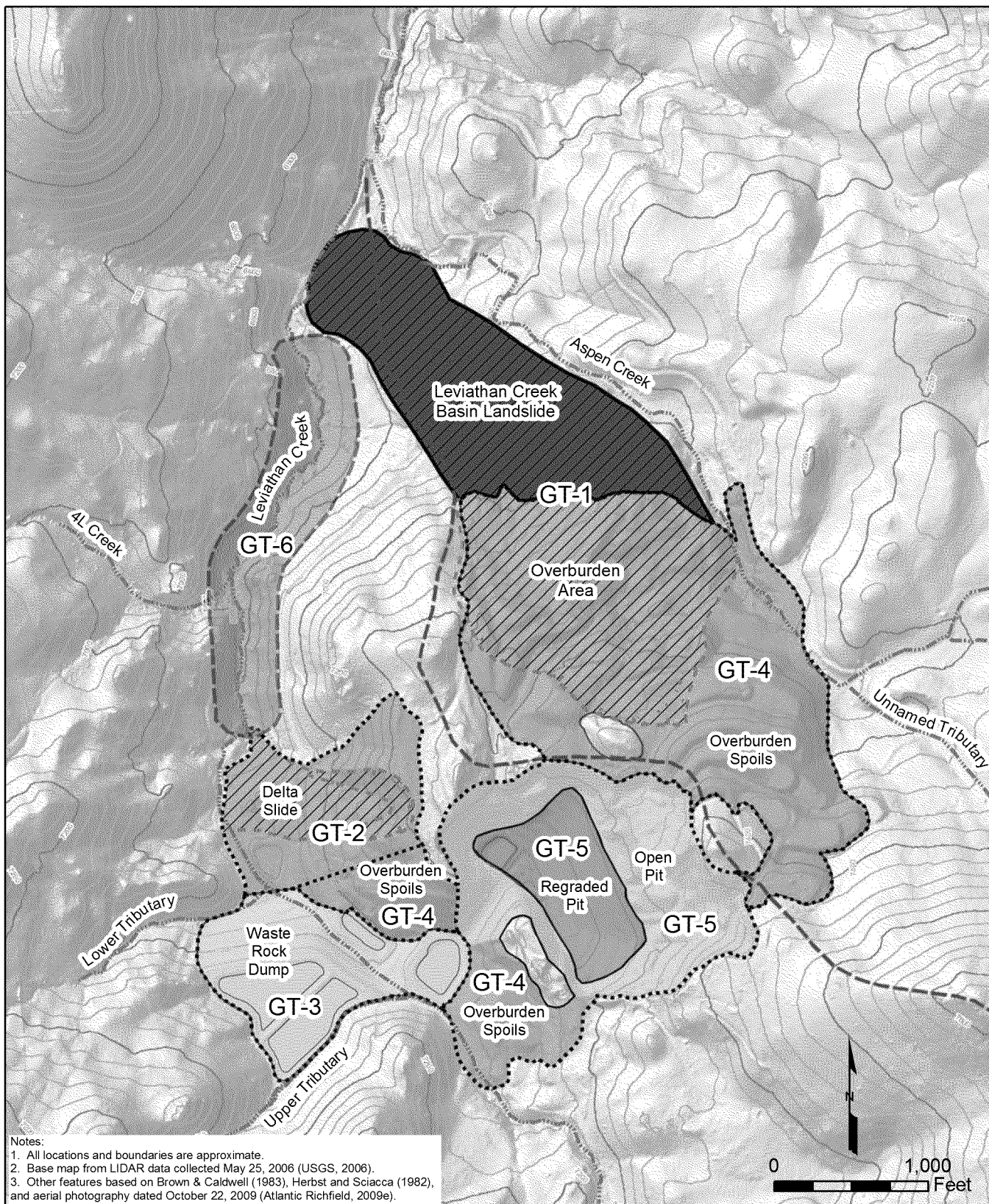
Comment No.	Comment	Response
		<p><b>Status:</b> Core review and surface geophysical surveys were completed. One geotechnical borehole was advanced through mine waste to the target depth. A second borehole was advanced through mine waste, but drilling to the target depth in native material was not successful. Borehole geophysical logging, installing instrumentation in native material, and monitoring pore pressure and potential slope movement planned for the portion of the borehole in native material will not be conducted. Geotechnical laboratory analysis of mine waste samples was completed.</p> <p>The site-specific data, published data for geologic materials similar to the native materials encountered on site, and other readily-available information that are being compiled are sufficient to complete this task during the FS.</p> <p><b>SOW Task 5:</b> "Assessment of mine shafts, adits, tunnels and galleries to determine their interaction and connection with other structures."</p> <p><b>Process:</b> The locations of underground workings were identified from survey records, and the location and orientation of underground workings relative to geologic materials, monitoring wells, the Pit, and groundwater levels were examined using three-dimensional visualization tools.</p> <p><b>Data:</b> Historical survey data for underground workings, and RI hydrogeologic characterization data were compiled. Quantitative evaluation of that information is not required.</p> <p><b>Status:</b> Task complete.</p> <p><b>SOW Task 6:</b> "Geotechnical assessment of the existing evaporation pond berms for structural integrity as well as an assessment for increasing pond capacity through raising the berms and/or level of the outflow pipes. Consideration should be made of the seismicity of the surrounding area, height and competency of the impermeable liners, and the effect of potential wave action."</p> <p><b>Process:</b> Geotechnical properties of mine waste were determined via the Geotechnical FFS. Geotechnical properties of the native materials beneath the mine waste will be estimated based on published information for geologic materials similar to native materials identified via RI hydrogeologic characterization. Stability of the embankment slopes will be evaluated during the FS for the existing configuration and various alternative configurations as identified in remedial alternatives. The seismicity of the area will be taken into consideration by determining design ground surface accelerations from published sources. Liner condition and potential wave action will be considered in the FS.</p> <p><b>Data:</b> Geophysical data, lithology, and geotechnical laboratory data for mine waste were determined at two geotechnical boreholes as part of the Geotechnical FFS.</p> <p><b>Status:</b> Data collection is complete. Site-specific seismic characteristic identification is in progress, and evaluation of slope stability of various pond configurations will be evaluated in the FS. The data collection and evaluations are sufficient to complete this task.</p> <p><b>SOW Task 7:</b> "Geotechnical assessment of mine waste slopes and high walls for stability and safety. Conduct an evaluation of the stability of high walls at the pit, stability of slopes on mine waste piles and associated areas. The evaluation should focus on identifying areas where cut and/or fill of other engineering methods will be necessary to prevent the failure of slopes and associated hazards to human health and the environment. Evaluation of the optimal slopes for minimizing erosion and facilitating revegetation efforts shall be made."</p> <p><b>Process:</b> Additional geotechnical investigation is not needed to confirm that the pit highwall is marginally stable, or to inform the FS. In the event that additional geotechnical evaluations of the highwall are needed to implement a remedial action, they would be done in the remedial design phase.</p>



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		<p>Geotechnical characterization of mine waste conducted in the Geotechnical FFS will be used to support slope stability evaluation of pond embankments and other slopes in mine wastes as needed to evaluate remedial alternatives in the FS. Consideration of earthwork or other engineering measures to improve slope stability will be done as part of the FS as necessary to evaluate remedial alternatives.</p> <p><b>Data:</b> Geotechnical characterization data for mine waste were collected as part of the Geotechnical FFS. Geotechnical characteristics for other materials will be determined from published sources as necessary.</p> <p><b>Status:</b> Collection of site-specific geotechnical data is complete and sufficient to evaluate slope stability and remedial alternatives during the FS. Data collection and evaluations are sufficient to complete this task.</p> <p><b>SOW Task 8:</b> "Landslide Area Evaluation. The landslide extending from the overburden waste pile to the vicinity of the confluence of Leviathan and Aspen Creeks is known to be active. Water quality of ponds and seeps indicates that acidic conditions are present within the landslide. The proximity of mine wastes at the head of the landslide begs the question as to whether continued movement of the slide could enhance the migration of mine wastes to the environment. A geotechnical assessment of the landslide area is necessary to determine the potential for mine wastes to be mobilized by continued landslide activity. In addition, investigation are necessary to determine if water flow through the landslide mobilizes mine waste constituents and/or contributes to continued instability of the landslide."</p> <p><b>Process:</b> Examination of recent aerial photographs and ground level reconnaissance confirmed that the lateral extent of the Leviathan Creek Basin Landslide and the Delta Landslide delineated by previous workers is consistent with current conditions. Atlantic Richfield has not observed movement of the Leviathan Creek Basin Landslide during the last 10 years sufficient to require repair of roads or the Aspen Seep Bioreactor. Based on that, the Leviathan Creek Basin Landslide does not appear to be moving enough to affect infrastructure, in contrast to movement rates of 0.7 to 5.8 meters per year from 1954 to 1988 reported in John Sciacca's thesis (Sciacca, J.E., 1983, <i>Historical and Environmental Geologic Study of the Leviathan Creek Basin Landslide</i>, University of California Davis).</p> <p>Movement of dissolved constituents derived from mine waste is evaluated in the RI.</p> <p><b>Data:</b> No additional quantitative data has been generated.</p> <p><b>Status:</b> Task complete.</p>
S2	<b>Acid Mine Drainage:</b> Please outline how the field sampling in the acid pond area will be utilized to inform understanding of acid mine drainage within the slide itself; and identify opportunities for addressing the acid water, rather than relying on seepage to migrate through the slide and impact surface water.	<p>Characterization of the Acidic Pond area adjacent to Leviathan Creek is not within the scope of the Geotechnical FFS TSAP, nor is identifying opportunities for addressing the formation and migration of acid rock drainage.</p> <p>Investigation activities described in Amendment No. 11 to the On Property Focused Remedial Investigation Work Plan – <i>Task Sampling and Analysis Plan for Surface Water/Groundwater Interaction Investigation near Acidic Pond and Leviathan Creek</i> are being conducted to assess the relationship between groundwater and surface water near Leviathan Creek, including in the vicinity of the Acidic Pond.</p>





#### Explanation

GT1 - Leviathan Creek Basin Landslide	----- Creek
GT2 - Delta Area	~~~ Landslide scarp (ticks indicate the direction of the dip)
GT3 - Pond Embankments and Waste Rock Dump	~~~ Inferred landslide scarp (ticks indicate the direction of the dip)
GT4 - Overburden Stockpiles	--- Surface drainage divide
GT5 - Open Pit	/// Reported landslide areas
GT6 - Other On-Property Areas	
█ Potential Area for New Storage Pond	

### GEOTECHNICAL EVALUATION AREAS Leviathan Mine Site Alpine County, California

By: DPV  
Date: 01/11/2017

Project No. 0013091



Figure  
**A-2**